

A Dissertation on

**STUDY OF REPEAT INTERVENTION
IN BENIGN BILIARY TRACT DISEASES**

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TAMIL NADU**



**KILPAUK MEDICAL COLLEGE
CHENNAI.**

BONAFIDE CERTIFICATE

This is to certify **Dr.A.ANBU SASIVANNAN** a bonafide MS General Surgery Post Graduate Student, from Government Royapettah Hospital, Kilpauk Medical College, Chennai-600 010 has submitted the dissertation on “**STUDY OF REPEAT INTERVENTION IN BENIGN BILIARY TRACT DISEASES**” in partial fulfilment of the requirements for M.S. General Surgery (Branch-I) Degree examination of **THE TAMIL NADU Dr.M.G.R.MEDICAL UNIVERSITY, GUINDY, CHENNAI**, to be held in March 2008.

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INTRODUCTION

Repeat biliary interventions after the primary biliary surgery, continues to be an important clinical problem resulting in serious morbidity and mortality to the patients. Prompt recognition of cause is essential for planning therapy.

The patients are presented at varied time interval and with different symptoms after the initial primary surgery.

The ease of management, operative risk and outcome of repeat biliary surgeries vary considerably and are highly dependent on the initial primary surgery.

We have attempted to study the spectra of biliary re-intervention and its outcome in Government Royapettah Hospital.

GENERAL CONSIDERATION

Although great progress has been made in hepatobiliary surgery, the incidence of complication and need for remedial measures has increased especially following advanced laparoscopic procedures. The incidence of biliary injuries following laparoscopic procedure has been found unto threefold higher than that of open procedure.

The popularity of laparoscopy and various percutaneous endoscopic procedures for bile duct pathologies have made the younger generation of surgeons less familiar with open cholecystectomy and open operative approaches to bile duct injuries.

Most of The patients present early after their initial operation. The clinical presentation varies with time.

The common causes are

- retained /recurrent bile duct stones
- bile duct stricture
- unrecognized bile duct injuries
- residual cholecystitis with/without stone
- Papillary stenosis/biliary dyskinesia.
- stenosis after cholangiojejunostomy

Many researchers have attempted to develop preoperative risk stratification to reduce the incidence of re-biliary intervention. Consensus is limited, but a proper preoperative workup should include complete evaluation of extra hepatic biliary tract.

Appropriate skill levels are needed in handling repeat intervention. This invariably needs advanced skill set and should always be attempted in high volume center.

SURGICAL ANATOMY OF EXTRAHEPATIC BILIARY SYSTEM

RIGHT AND LEFT HEPATIC DUCTS:

Right hepatic duct = union of the anterior and posterior

Segment ducts

Left hepatic duct = union of the medial and lateral

Segment duct

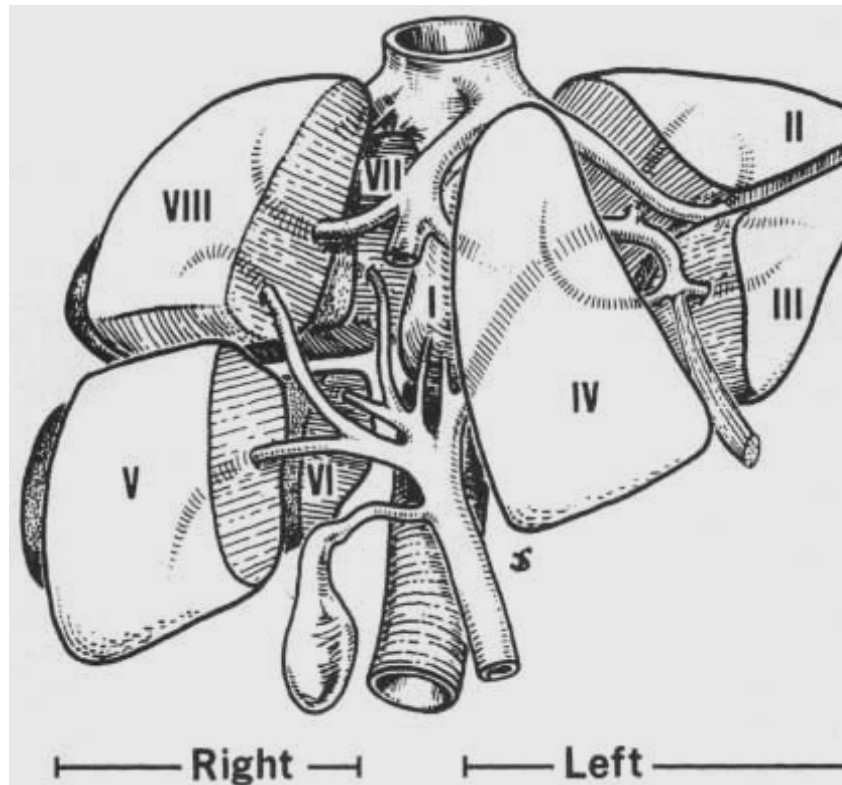
- **DIAMETER:** Right duct - 3 mm, Left duct - 5 mm
- **LENGTH :** Right duct - 0.9cm, Left duct - 1.7cm

The right and the left hepatic ducts emerge at the porta hepatic from right and left lobes of the liver in the shape of “ V ”. Left hepatic duct has a greater propensity for dilatation as a consequence of distal obstruction. The right hepatic duct has a very short extra hepatic course and it is about 1 cm long.

ARRANGEMENTS:

The arrangement of structures at the porta hepatis, from behind forwards, is the branches of the portal vein, hepatic artery and hepatic ducts.

FORMATION COMMON HEPATIC DUCT



Right. hepatic duct = union of the anterior and posterior

segment ducts

Left. hepatic duct = union of the medial and lateral

segment duct

COMMON HEPATIC DUCT:

SIZE : About 4 cm [1.5 inches] long.

DIAMETER : 0.4 cm

COURSE :

The main right and left hepatic ducts unite near the right end of the porta hepatis as the common hepatic duct which descends about 3 cm before being joined on its right at an acute angle by the cystic duct to form the main bile duct.

It makes up the left border of the triangle of Calot. Several arteries are found anterior or posterior in relation to the common hepatic duct.

ARRANGEMENTS

The common hepatic duct lies to the right of the hepatic artery and anterior to the portal vein.

GALL BLADDER:

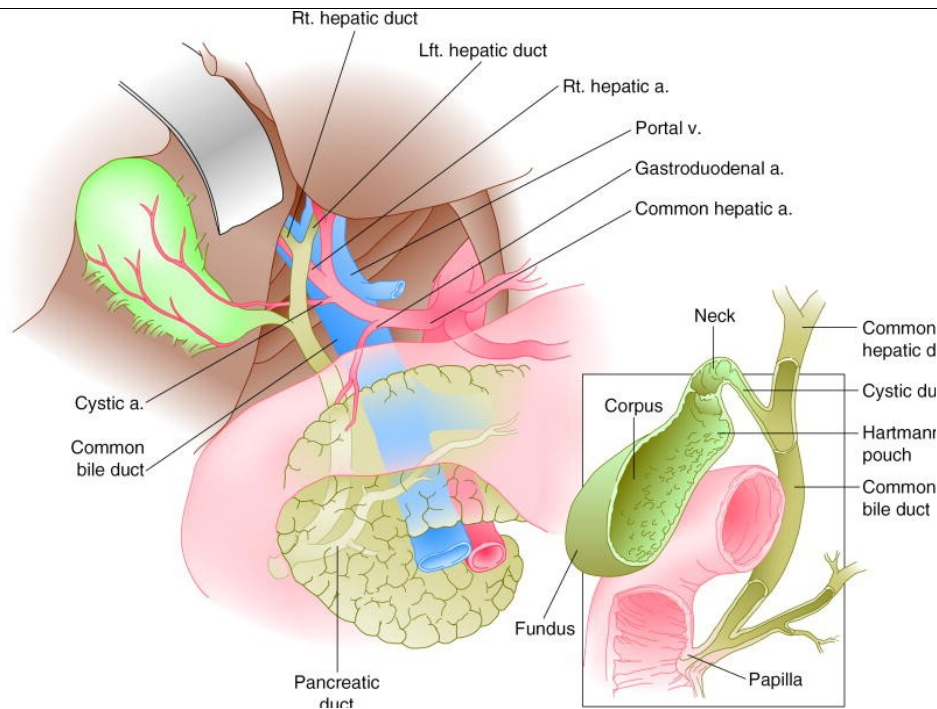
A reservoir for bile.

SHAPE : Piriform or pear-shaped sac.

DIMENSIONS : It is a hollow organ. 7-10 cm long, 3 cm broad at its Widest.

CAPACITY : 30-50 ml

POSITION : It is partly sunk in a fossa in the right hepatic lobe's inferior surface. It typically lies in close proximity to the duodenum, pylorus, and hepatic flexure of the right colon and right kidney.



PARTS: Gall bladder is divided into the following parts:

(a) FUNDUS:

It is generally the least well vascularised portion of the gall bladder and therefore it is more susceptible to ischemic changes, including perforation.

(b) BODY:

The body is directed up, back and to the left, near the right end of the porta, it is continuous with the bladder neck.

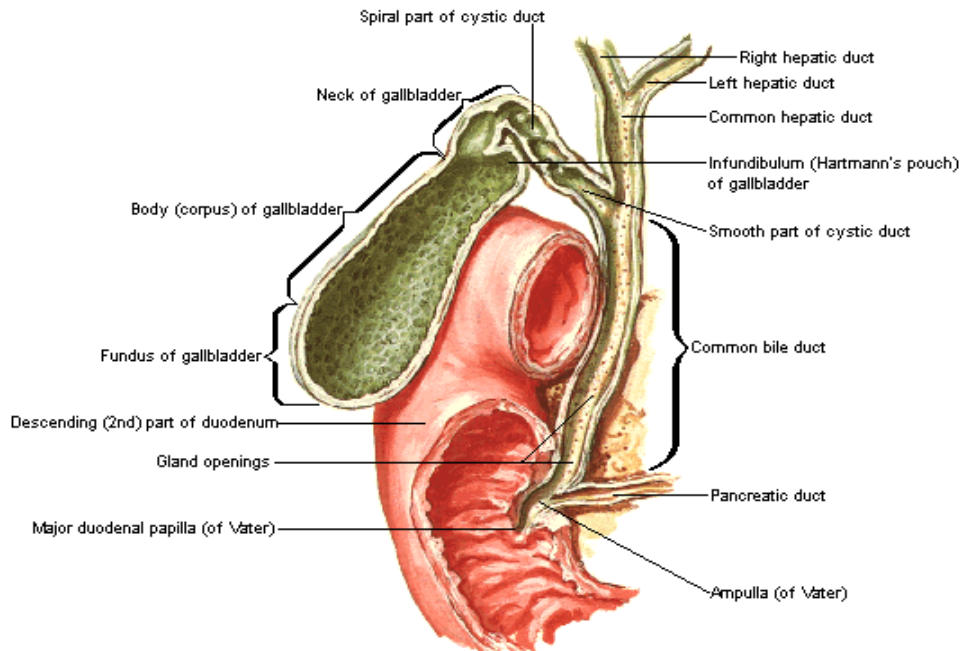
(c) NECK:

The neck is narrow, curving up and forwards and then abruptly back and downwards, to become the cystic duct, at which transition there is a constriction. The mucosa of the neck is obliquely rigid, forming a spiral groove.

(d) INFUNDIBULUM:

Also known as the Hartman's pouch which is a small bulbous diverticulum. Gallstones lodged in the pouch may cause adhesions with the duodenum or bile duct, and may perforate into any one of them.

Gallbladder and Extrahepatic Bile Ducts Sectioned



CYSTIC DUCT:

SHAPE : 'S' Shaped

SIZE : 3-4 cm

COURSE : It passes back, down and to the left from the neck of the gall bladder, joining the common hepatic duct to form the bile duct. Its mucosa bears five to twelve crescentic folds like those in the gall bladder's neck. They project obliquely in regular succession, appearing like a "Spiral valve" [of Heister].

The cystic duct joins the hepatic duct at an angle of about 40 degree in 64-75% of individuals.

COMMON BILE DUCT:

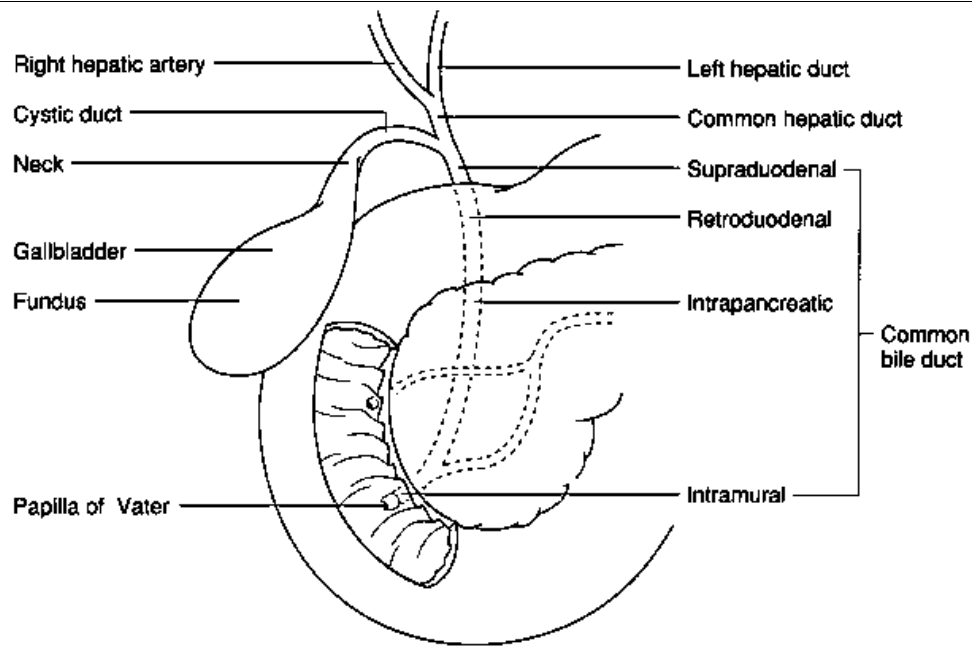
The bile duct is formed near the porta hepatis, by the junction of the cystic and common hepatic ducts.

The gastroduodenal artery lies to the left of the CBD. The post-superior pancreatico duodenal artery lies anterior to the CBD. The middle colic artery lies anterior to the common bile duct and other arteries.

According to its course it has 4 parts,

- | | |
|---------------------------------|---------------|
| (a) Supra duodenal portion | -2cm to 5cm |
| (b) Retro duodenal portion part | -1cm to 3.5cm |
| (c) Infra duodenal portion | - 2cm to 5cm |
| (d) Intra duodenal portion | -1.5cm |

DIMENSIONS: about 7.5 cm long and 6 mm in diameter



COURSE OF CBD

The bile duct runs downwards and backwards, first in the free margin of the lesser omentum [Supra duodenal portion] then behind the first part of the duodenum [retro duodenal portion] and lastly behind or embedded in the head of the pancreas [infra duodenal portion].

Near the middle of poster medial wall of the second part of the duodenum is in contact with pancreatic duct and accompanies it in the wall of the duodenum, just to the right of the second or third lumbar vertebra where the two ducts unite to form the hepato-pancreatic ampulla or ampulla of Vater.

The distal constricted end of ampulla opens at the summit of the major duodenal papilla (8-10cm distal to pylorus). The opening is guarded by the sphincter of the ampulla (of ODDI).

The intramural part of bile duct before it enters the ampulla of Vater is surrounded by the sphincter of the bile duct (of BOYDEN). [Intra duodenal portion]

Variation in the distance between the pancreatobiliary junction and the tip of the papilla are the developmental processes.

BLOOD SUPPLY OF BILIARY APPARATUS:

Upper part of biliary tract supplied by

Supraduodenal & : Rt and Lt branch of Hepatic artery
Hilar segments and Cystic artery

Lower part of biliary tract supplied by:

Common hepatic artery

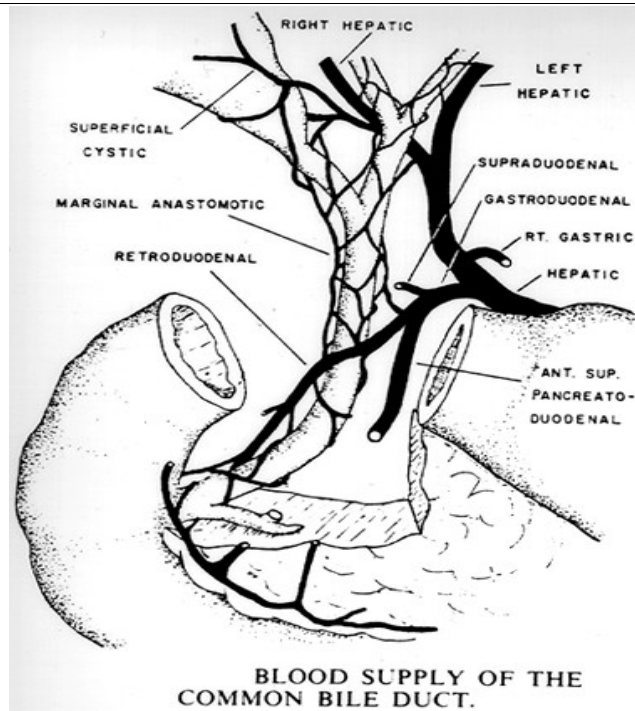
Gastro duodenal artery

Supraduodenal artery

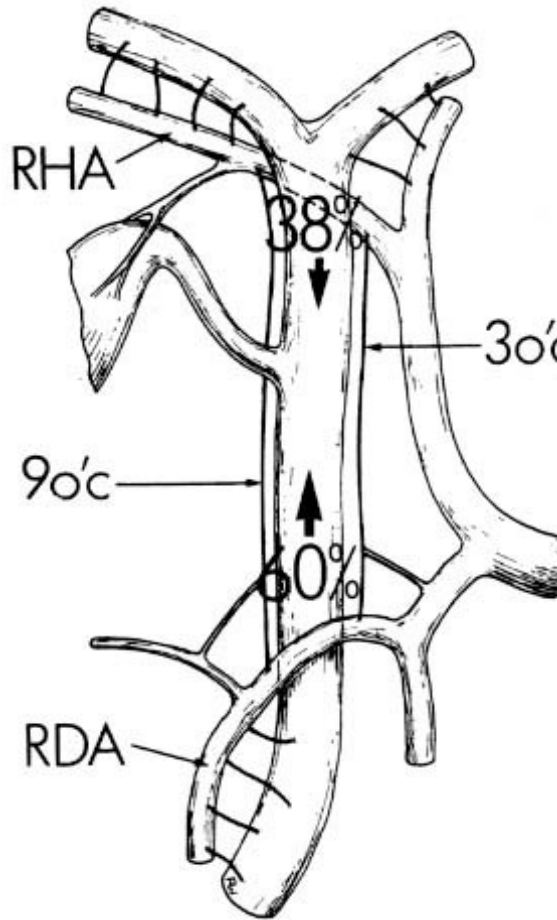
Anterior and posterior

Pancreaticoduodenal artery

Hilar plate plexus represents a vascular communication between the right and left hepatic arteries and allows blood supply to the right hepatic duct and maintained after occlusion of the right hepatic artery and transaction of the common hepatic duct



The cystic artery usually arise from the right hepatic artery passes behind the common hepatic and cystic duct in the Calot's triangle and reach the upper surface of the neck of the gall bladder, where it divides into superficial and deep branches. Occasionally, the cystic artery arises from the hepatic artery proper, and rarely from the gastro duodenal artery. Then it passes in front of, or behind, the bile duct or the common hepatic duct, to reach the upper surface of neck of gall bladder.



The proximal or hilar ducts and the retropancreatic bile duct receive a rich blood supply. The supraduodenal bile duct supply is axial and tenuous, with 60% from below and 38% from above.

The supraduodenal segment of the bile duct (common hepatic duct and the supraduodenal CBD) have the most precarious blood supply compared to the retropancreatic (lower CBD) and hilar (right and left hepatic ducts) segments.

The arterial supply of the supraduodenal bile duct is axial with 2 main arteries that run along the lateral borders of the bile duct. These vessels, called "9 o'clock" and "3 o'clock" marginal arteries, mainly arise

from the branches of the retroduodenal, gastroduodenal, retro portal, right hepatic, and cystic arteries and receive majority of their blood from below (60%) and the rest from above

The epicholedochal arterial plexus of the common bile duct is derived from the retroduodenal or posterior superior pancreaticoduodenal arteries. The collateral circulation is enhanced by two intramural plexus. They may be compressed between the oedematous mucosa and the external tough fibrous coat in pathologic condition such as cholangitis.

VENOUS DRAINAGE:

1. The superior surface of gall bladder drains directly into the hepatic veins through the gall bladder fossa.
2. Rest of gall bladder drains by one or two cystic veins, which commonly enter the liver, either directly or after joining the veins draining the hepatic duct and upper part of the bile duct. Only rarely the cystic vein opens into the right branch of portal vein.
3. The lower part of the bile duct drains into the portal vein.

LYMPHATIC DRAINAGE:

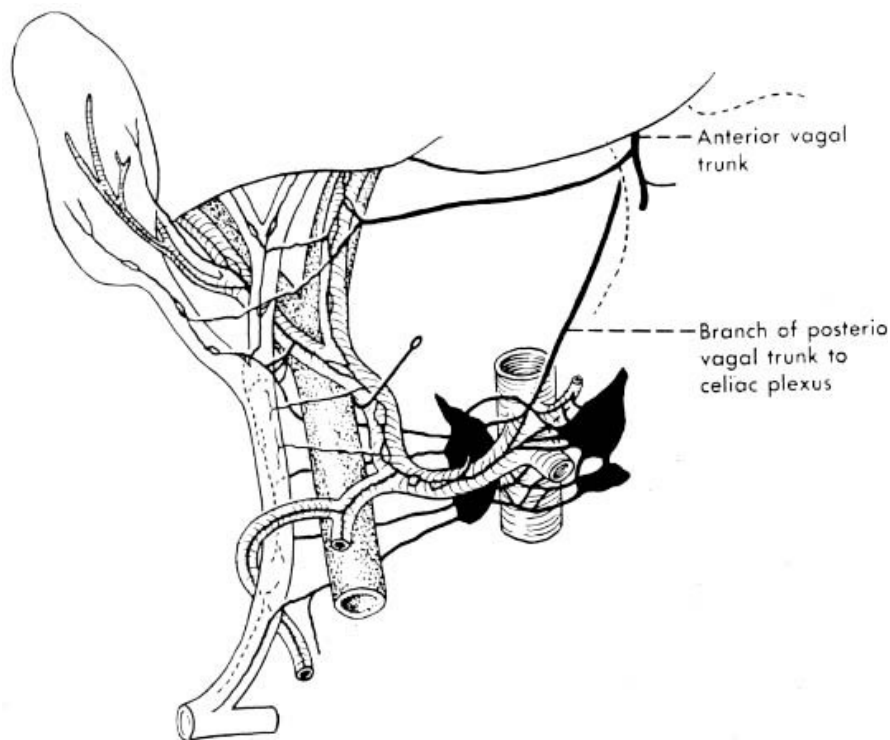
1. Lymphatic's from the gall bladder cystic duct, hepatic duct and upper part of the bile duct pass to the cystic node and the node of the anterior border of the epiploic foramen; The cystic nodes lie in the angle between the cystic and the common hepatic ducts;

2. The lower part of the bile duct drains into the lower hepatic and the upper pancreaticosplenic nodes.

NERVE SUPPLY:

The cystic plexus of nerves, supplying the territory of the cystic artery is derived from the hepatic plexus, which receives fibres from the coeliac plexus, left and right vagus and the right phrenic nerves. The nerve plexus over the superior pancreaticoduodenal artery supplies the lower part of the bile duct.

NERVE SUPPLY OF EXTRAHEPATIC BILIARY TRACT



Parasympathetic nerves are motor to musculature of the gall bladder and bile ducts, but inhibitory to the sphincters of the bile duct. Gall bladder pain via vagus is referred to stomach.

Sympathetic nerves (T₇₋₉) are vasomotor and motor to sphincters. Pain via sympathetic nerves is referred to the inferior angle of the scapula.

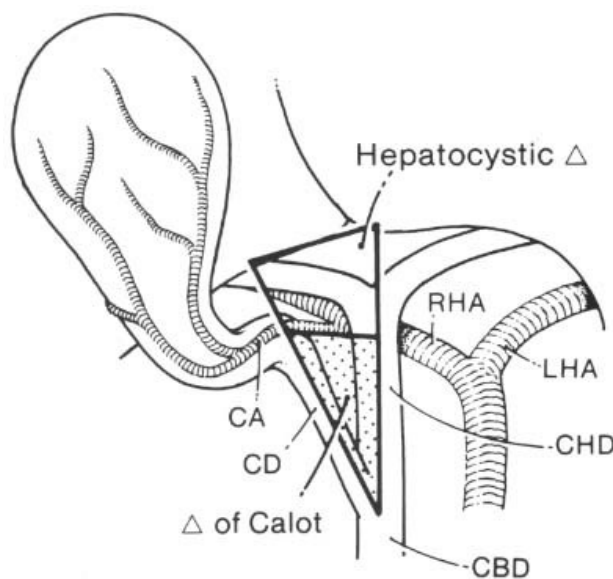
Pain via the phrenic nerve is referred to the right shoulder.

HEPATO CYSTIC TRIANGLE, TRIANGLE OF CALOT, AREA OF MOOSMAN:

Hepatocystic triangle is formed by the proximal part of the gallbladder and cystic duct to the right, the common hepatic to the left, and the margin of right lobe of liver superiorly

The triangle originally described by CALOT, define the upper border as the cystic artery.

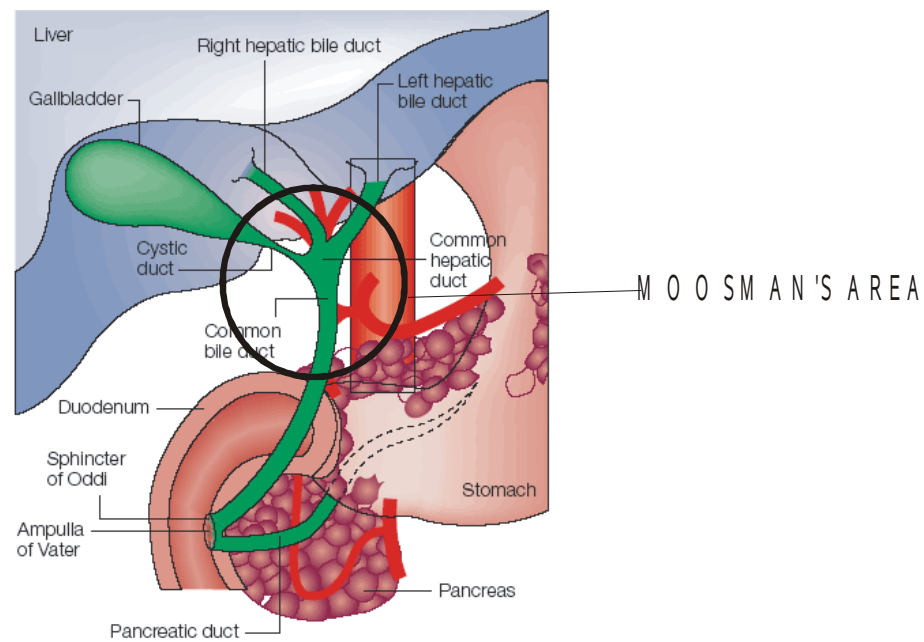
The presence of epicholedochal plexus helps the surgeon to identify the common bile duct. There is no such venous plexus on the surface of the cystic duct.



The area of MOOSMAN is circular area 30mm in diameter fits in to the hepato cysticduct angle

85% of all the variations in the hepatic pedicle are found in Mossman's area and 50% of these variations are potentially hazard during cholecystectomy.

In the Mossman's area are several structures that must be identified before they are ligated and sectioned. The right hepatic artery, common bile duct, aberrant hepatic artery (if present), and cystic artery.



ANOMALIES

- A. ANOMALIES OF THE GALL BLADDER
- B. ANOMALIES OF THE DUCTS
- C. ANOMALIES OF BLOOD VESSELS

I. ANOMALIES OF GALL BLADDER:

SIGNIFICANCE: Anomalies of the gall bladder per se are generally of minimal clinical significance. .

(I) ABNORMAL NUMBER:

- a. Hypoplasia or agenesis of gall bladder
- b. Double gall bladder

(ii) ABNORMAL SHAPE:

- a. Phrygian cap or folded fundus.
- b. Bilobulated gall bladder.
- c. Hour glass gall bladder

(iii) DIVERTICULUM OF THE GALL BLADDER

(iv) TRABECULATED GALL BLADDER:

This leads to impaired function

(vi) ABNORMAL MESENTERY

- a. absent mesentery
- b. long mesentery or floating gall bladder:

(vii) ATRESIA OF GALL BLADDER

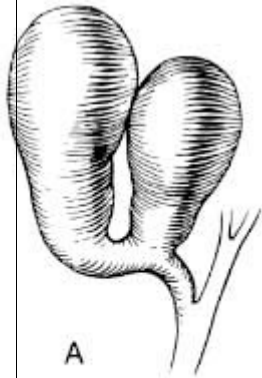
ANOMALIES OF GALL BLADDER



A) Phrygian cap deformity.



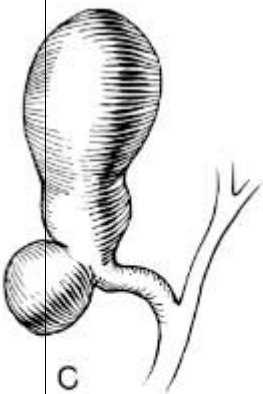
B) Hartmann's pouch of the infundibulum.



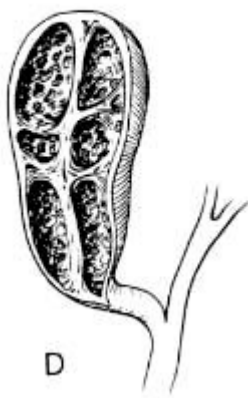
A: Bilobed gallbladder



B: Hourglass gallbladder



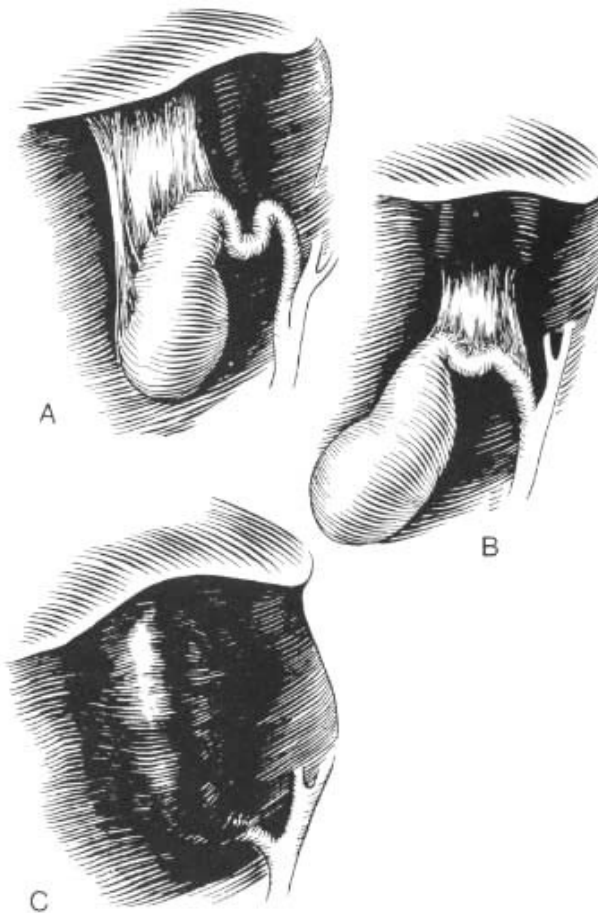
C: Congenital diverticulum of the infundibulum gallbladder



D: Septated gallbladder

(iv) ABNORMAL POSITION OF THE GALL BLADDER

- a. Intrahepatic gall bladder (most common)
- b. transposition or left sided gall bladder
- c. falciform ligament:
- d. abdominal wall
- e. retrodisplacement:
- f. retroperitoneal



A, Floating gallbladder with mesentery.

B, Cystic duct with mesentery.

C, Intrahepatic gallbladder

II. ANOMALIES OF THE DUCT:

SIGNIFICANCE:

Anomalies of the cystic duct and bile duct are of much greater clinical significance than the defect of the gall bladder. Over 50 percent of all patients undergoing a biliary tract procedure will have either a ductal or an arterial anomaly. Failure to recognise the abnormalities of the cystic duct and common bile duct junction is a commonly reported cause of inadvertent bile duct injury during cholecystectomy. These are as follows

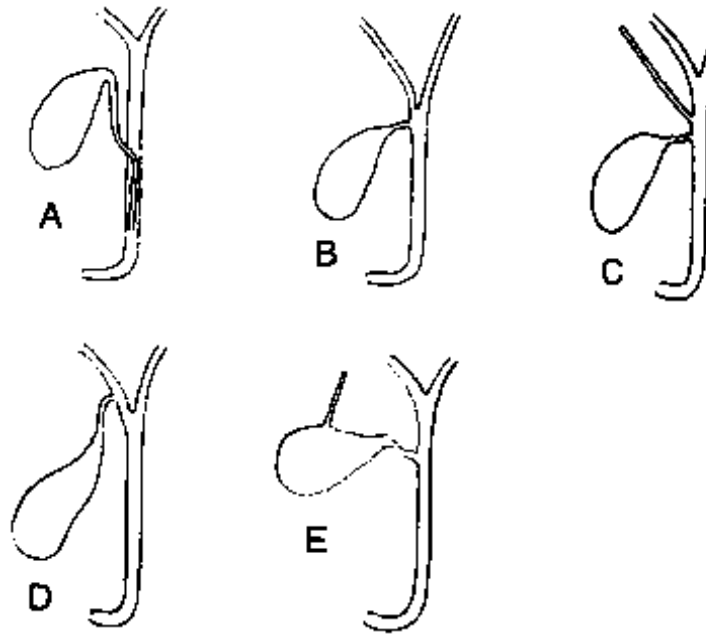
A. ANOMALIES OF THE CYSTIC DUCT:

1. Absence of cystic duct:
(neck of gall bladder opens into the common bile duct).
2. Two cystic ducts
3. Low insertion of the cystic duct

Cystic duct runs parallel to the common bile duct unusually long distance before joining this structure. The cystic duct opens in common bile duct near the Ampulla of Vater. This occurs in up to 25 percent of patients.

4. High insertion of the cystic duct:
5. Cystic duct drain in the right hepatic duct.
6. Cystic duct drains into the left hepatic duct.
7. Cystic duct drains into the anterior wall of the common bile duct.
8. Cystic duct opens into the posterior wall of the common bile duct.

CYSTIC DUCT ANOMALIES.



A: Long cystic duct with low fusion with common hepatic duct.

B: Abnormally high fusion of cystic duct with common hepatic duct (trifurcation).

C: Accessory hepatic duct.

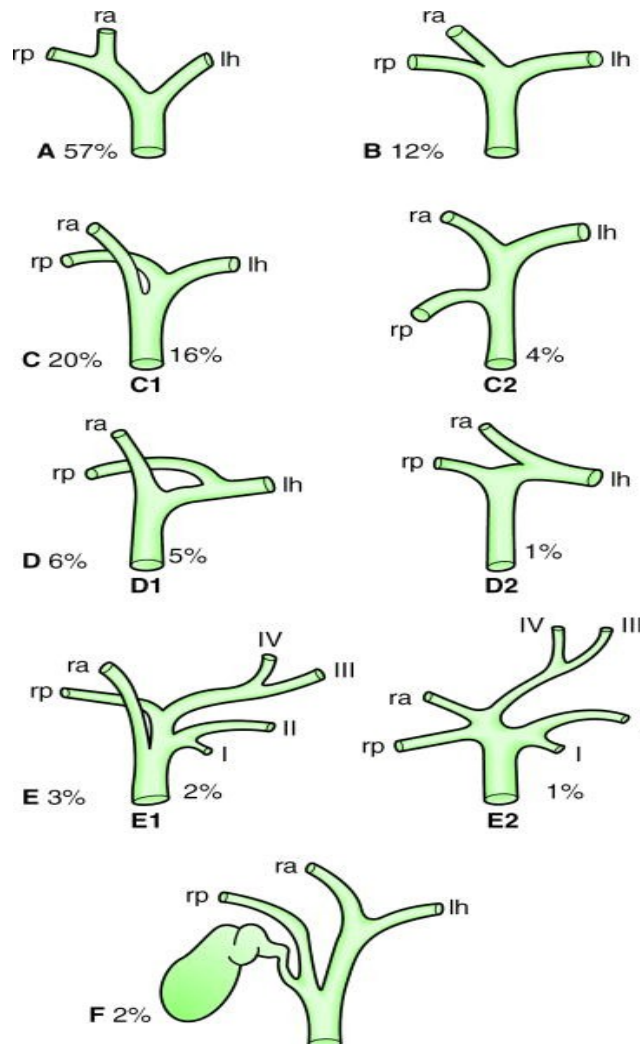
D: Cystic duct entering right hepatic duct.

E: Cholecystohepatic duct.

9. The spiral cystic duct runs down and behind the common hepatic duct to enter on its medial aspect in 35%.
10. The cystic duct may also run a parallel course with the bile duct both being enclosed in the common fibrous sheath. 5-7%
11. Long cystic duct entering the common duct close to the duodenum.

B. ANOMOLIES OF HEPATIC DUCT

It may emerge more often from the right lobe to join the main hepatic duct or, rarely, the gall bladder itself. Also known as bile duct of Lushka and about 1-2 mm in diameter. It is present in 1% of the cases. If these are overlooked during removal of the gall bladder, persistent leakage of bile results from the bed.



- A) Most common anatomy. Trifurcation at the confluence.
- B) Rt. sectoral ducts drains in to the CHD
- C) Rt. Sectoral ducts drains in to the Lt. Hepatic duct
- D) and E) Absence of a hepatic duct confluence.
- F) Absence of right hepatic duct and drainage of right posterior sectoral duct into the cystic duct

C. ANOMALIES OF THE COMMON BILE DUCT

1. DIFFERENT WAYS OF OPENING OF COMMON BILE DUCT AND MAIN PANCREATIC DUCT INTO THE DUODENUM:

- a. Both ducts may open independently into the ampulla of Vater.
- b. Both ducts may not join, but each may separately enter and discharge on the eminence of the duodenal papilla.
- c. Both ducts may join together extraduodenally to form a common channel and then open into the duodenum.

2. ABSENT COMMON BILE DUCT

The right and left hepatic ducts join the gall bladder and the duct draining the gall bladder takes the course of normal common bile duct to the duodenum. It is very rare.

3. ACCESSORY BILE DUCT

4. ABNORMAL OPENING OF THE COMMON BILE DUCT

5. ATRESIA OF THE COMMON BILE DUCT:

Occasionally atresia is limited to a small portion of the bile duct only.

III ANOMALIES OF BLOOD VESSELS:

SIGNIFICANCE:

Arterial anomalies are also quite common and need to be recognised during surgery on the biliary tract to minimise the chance of intra-operative complications.

It includes

A. ANOMALIES OF HEPATIC ARTERY

Due to anomalous origin or the mis- identification of the right hepatic artery can be injured during cholecystectomy.

1. ANOMALOUS ORIGIN

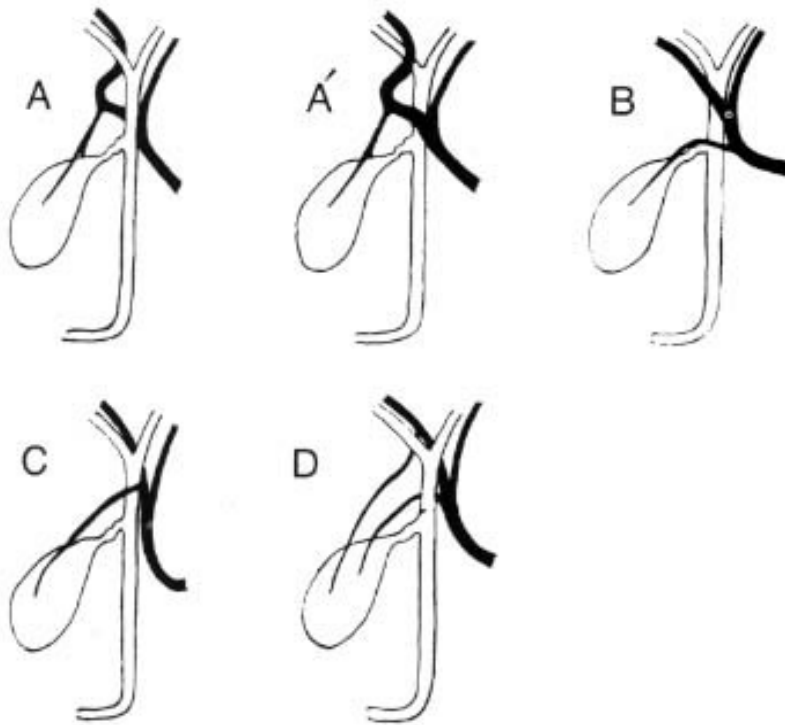
- a. Right hepatic artery arising from the superior mesenteric artery, this is most common and it occurs in up to 20% of patients.
- b. In 5% of the patients two hepatic arteries are seen and from common hepatic and other from the superior mesenteric artery.
- c. Common hepatic artery coming off from the superior mesenteric artery.
- d. The left hepatic artery arising from the left gastric artery.
- e. Double hepatic arterial system with one arising from common hepatic and other arising from superior mesenteric artery.

2. ANOMALOUS COURSE:

- a. The right hepatic artery lying anterior to the common hepatic duct –it is of particular importance during performance of biliary tract surgery

- b. **CATERPILLAR TURN OR MOYNIHAN'S HUMP:** It is the most dangerous anomaly. It occurs when the hepatic artery takes a tortuous course in front of the origin of the cystic duct or the right hepatic artery is tortuous, and the cystic artery is short. This tortuosity is known as Moynihan's hump. The presence of the "caterpillar hump" right hepatic artery should be suspected when an unusually large "cystic artery" is viewed through the laparoscope.

HEPATIC AND CYSTIC ARTERY ANOMALIES



A: "Caterpillar hump" right hepatic artery.

B: Right hepatic artery anterior to common hepatic (or common bile) duct.

C: Cystic artery anterior to common hepatic (or common bile) duct.

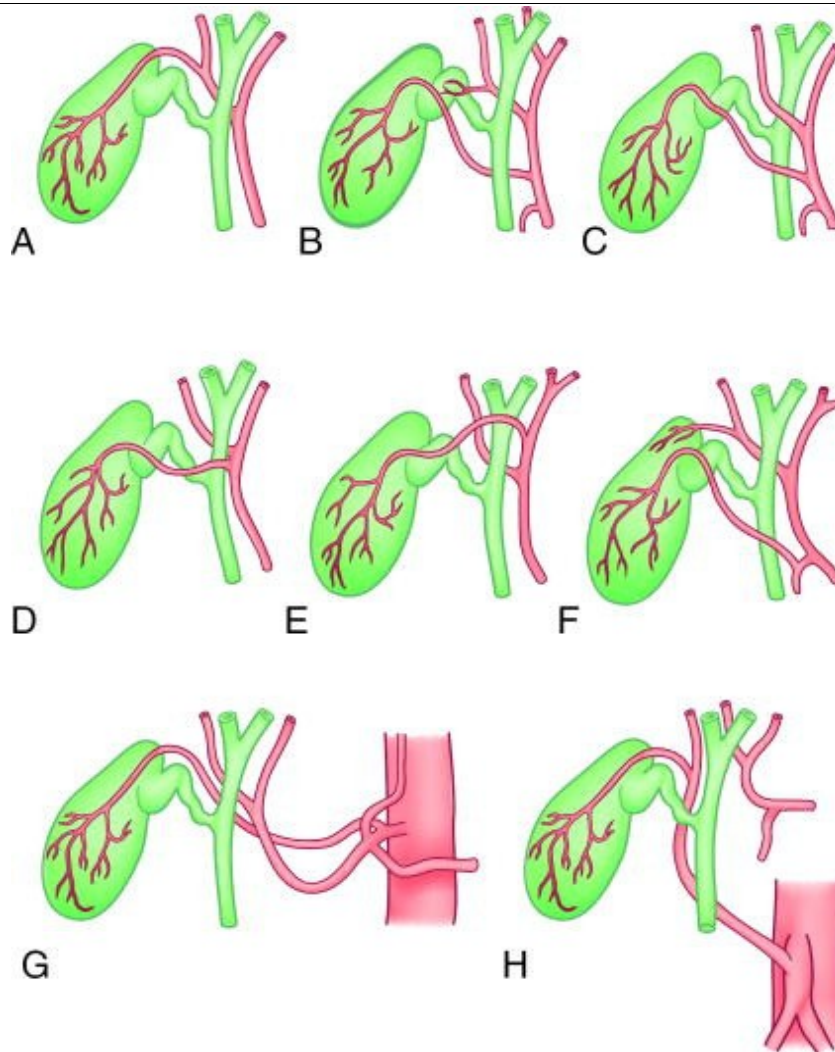
D: Accessory cystic artery.

ANOMALIES OF CYSTIC ARTERY :

The cystic artery arises from the hepatic artery within the hepatocystic triangle in approximately 80% of the individuals. As it crosses the hepatocystic triangle, the cystic artery often supplies the cystic duct with one or more of its branches. Although generally overlooked in the open cholecystectomy these branches can cause severe bleeding during laparoscopic cholecystectomy. Anatomic variations of the cystic artery are recognised in 50% of the individuals.

- a. **ACCESSORY CYSTIC ARTERY:** It arises from the gastroduodenal artery.
- b. Cystic artery can be on occasion be a branch from the Left hepatic artery or main hepatic artery or coeliac axis
- c. In 15 percent of the cases the cystic artery crosses in front of the common hepatic duct and cystic duct.
- d. Two cystic arteries arising from the right hepatic artery.
- e. In 20% of the cases double cystic arteries are seen one or both of which may arise from the right hepatic artery or one may have an abnormal origin from gastroduodenal.

ANOMALIES OF CYSTIC ARTERY



A. Usual origin and course of the cystic artery.

B. Double cystic artery.

C. Cystic artery crossing anterior to main bile duct.

D. Cystic artery originating from the right branch of the hepatic artery and crossing the common hepatic duct anteriorly.

E. Cystic artery originating from the left branch of the hepatic artery.

F. Cystic artery originating from the gastroduodenal artery.

REPEAT INTERVENTION FOR BENIGN BILIARY TRACT DISEASE

Re-intervention for the benign biliary disease was performed in patients who suffered from the complication directly relevant to previous biliary duct operations. It's a morbid, costly, and occasionally fatal surgery.

The causes for re-intervention included residual and retained bile duct stones, bile duct injury or stenosis after injury, residual cholecystitis with or without stones, stenosis after cholangiojejunostomy, stenosis of oddi's sphincter, constrictive papillitis etc...

The procedure for first operation commonly includes open and laparoscopic cholecystectomy, open and laparoscopic CBD exploration, cholangio-enteric anastomosis.

A complete pre-operative evaluation is essential in minimizing the repeat intervention and that patients should be warned of the possibility of post operative symptoms which may start at any time from the immediate post op period to decade later.

RETAINED / REFORMED BILE DUCT STONES

Retained and recurrent bile duct stones mostly belong to multiple intrahepatic and extrahepatic bile duct stones. It is unreasonable to judge whether bile duct stones exist simply according to the diameter of bile duct or traditional examination.

We consider that it is necessary to increase preoperative diagnostic rate, understand conditions of the biliary tract by using imaging techniques and cholangiography, and ascertain the location, number, size of stones and whether stenosis or dilation of the bile duct or combined disease exists.

Micro-choledochoscopy is superior in treating residual bile duct stones. Intraoperative B-mode ultrasound helps surgeon to locate deep stones and decide surgical procedure.

Appropriate treatment for primary bile duct stone without any obvious dilatation of extrahepatic duct, T-tube drainage is needed.

In reoperation, patients with dilatation of extrahepatic bile duct hepaticojejunostomy with large caliber stoma should be performed.

BILE DUCT INJURY/STRICTURE:

Bile duct injuries occur following biliary/other operations

BILIARY SURGERY:

Laparoscopic cholecystectomy

Open cholecystectomy

Common bile duct exploration

NON BILIARY SURGERY:

Gastrectomy

Hepatic resection

Portocaval shunt

Pancreatic procedures

Stricture of bilio-enteric anastomosis

Blunt or penetrating trauma.

TYPES OF INJURIES

- Biliary leak (biloma & biliary fistula)
- Cystic duct injuries
- Extra/Intrahepatic duct injuries
- Strictures

MCMOHAN CLASSIFICATION OF MAJOR AND MINOR BILE DUCT INJURIES:**MAJOR BDI:**

- a) Laceration >25% of bile duct diameter
- b) Transection of CHD & CBD
- c) Post operative stricture

MINOR BDI:

- a) Laceration <25% of bile duct diameter
- b) Laceration of cystic-CBD junction. (Button hole tear)

MECHANISM OF BILE DUCT INJURIES:

| | |
|--|-------------|
| Anatomical anomalies | - 65% - 70% |
| Local pathology | - 15 %- 30% |
| Technical aspects | - < 2% |
| Human factors and cognitive psychology | - < 1% |

ANATOMICAL ANOMALIES

Misinterpretation of the anatomy has been implicated as dominant factor in the pathogenesis of bile duct injuries which account for 70%

Anomalies of the cystic duct

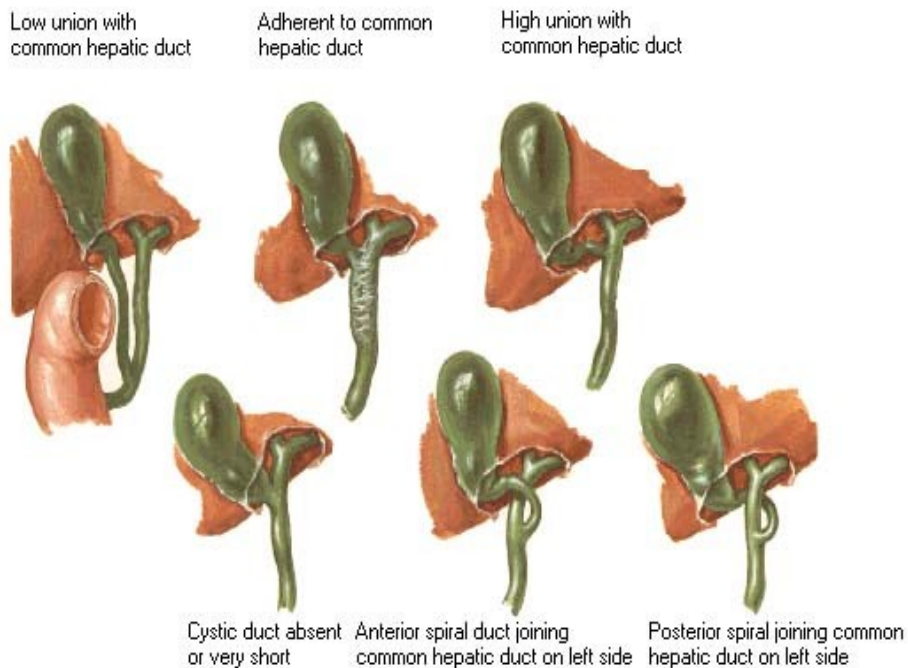
eg: long parallel course with the CHD

Spiraling cystic duct opening on medial aspect of CHD

Anomalies of the right hepatic duct

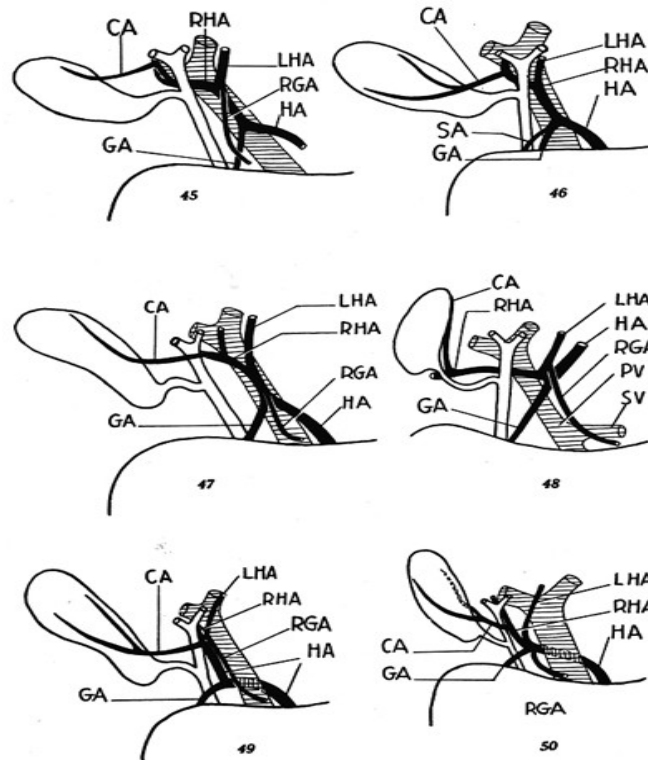
eg: low insertion on to the CHD

Right anterior and posterior sectoral ducts



Vascular anomalies occur in upto 20% of patients.

The most common of these is the right hepatic arterial supply arising in part or whole from the SMA. Such an aberrant vessel course to the right of portal vein, lateral and some what posterior to the CBD



LOCAL PATHOLOGY:

Dangerous pathological conditions include acute cholecystitis, chronic inflammation with dense scarring, fibrosis in the triangle of calot, makes more friable and difficult to grasp.

Examples:

Distorted normal anatomy increase the risk of Injury Excessive oozing of blood due to inflammation and vascularity.

Dangerous biliary pathology include polycystic liver disease and portal hypertension caused by cirrhosis or schistosomiasis.

Morbid obesity obscures the anatomy of calot's triangle.

HUMAN FACTORS AND COGNITIVE PSYCHOLOGY

Most of the laparoscopic bile duct injuries occur from visual perceptual illusion and not from skill/knowledge

TECHNICAL ERRORS:

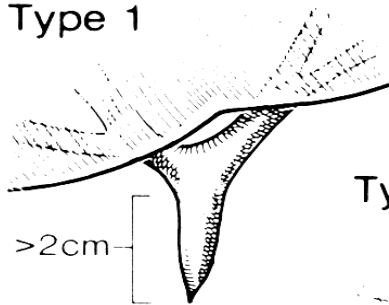
BDI occur even in the hands of experience and competent surgeons.

- Learning curve appears to affect the risk of BDI
- Inadequate exposure in open cholecystectomy (obesity) or improper placement of trocars, improper assistance including retraction hasty and injudicious application of clamps / clips to arrest bleeding is important factors often resulting in BDI.
- Overzealous use of electrocautery near the calot's triangle/ extensive dissection around the CBD damage it's axial blood supply leading to ischemic damage to the duct and late stricture formation.
- Hilar bleeding and subsequent attempts to achieve hemostasis is one of the most important technical errors for BDI.
- Dissection into the Liver parenchyma causes bleeding which obscure the anatomy / staying into the liver bed can damage the right sectoral hepatic duct/anomalous right hepatic artery/major right portal pedicle.and judgment.

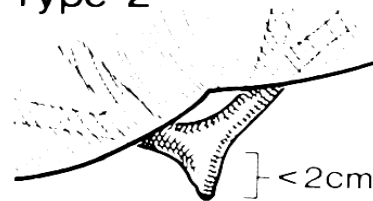
BISMUTH's CLASSIFICATION (1982)

| TYPE | CRITERIA |
|------------|---|
| I | Low CHD stricture with a length of the common hepatic duct stump of >2cm |
| II | Proximal CHD stricture hepatic duct stump <2cm |
| III | Hilar stricture, no residual CHD but the hepatic ductal confluence is preserved |
| IV | Hilar stricture, with involvement of confluence and loss of communication between right and left hepatic duct |
| V | Involvement of aberrant right sectoral hepatic duct alone/with concomitant stricture of the CHD |

Type 1



Type 2



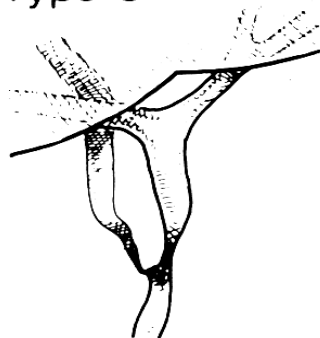
Type 3



Type 4

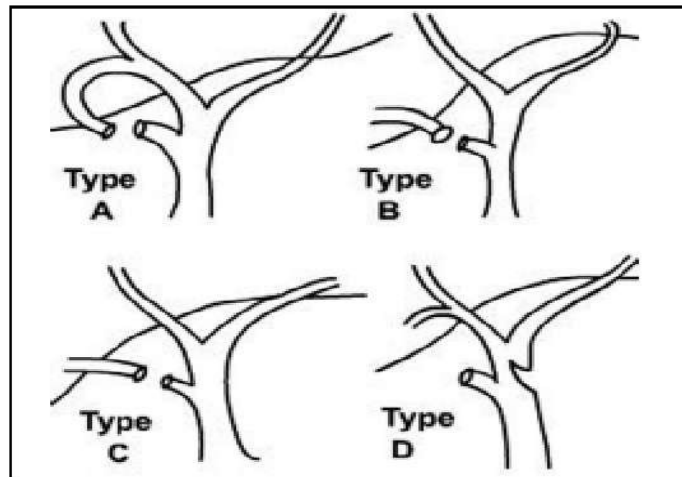


Type 5

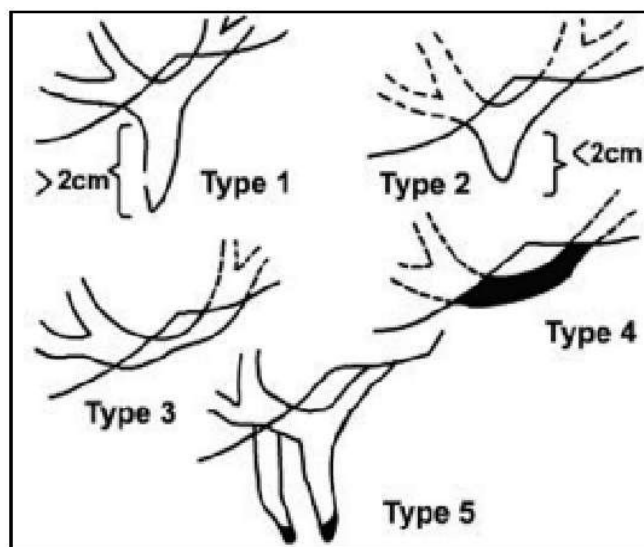


STRASBERG'S CLASSIFICATION (1995)

| TYPE | CRITERIA |
|-------------|--|
| A | Cystic duct leaks or leaks from small ducts in the liver bed |
| B | Occlusion of a part of the biliary tree, almost invariably the aberrant right hepatic ducts. |
| C | Transection without ligation of the aberrant right Hepatic ducts |
| D | Lateral injuries to major bile ducts |
| E | Subdivided as per Bismuth's classification |



Strasberg Types of laparoscopic extrahepatic bile duct injuries.
Type A to Type D



Type E1 to E5 of Strasberg classification
same as Bismuth Type 1 to Type 5 biliary strictures

CLINICAL PERSENTATION:

The time and type of clinical presentation of the patient subsequent to a biliary tract surgery varies with the type of injuries. Thus the injury may present in the following manners

A) THE INJURY DETECTED DURING PRIMARY SURGERY:

About 1/3 of the lesions are detected during the initial surgical procedure. It is seen that the detection of injury during the procedure was not dependent on the use of routine per operative cholangiography.

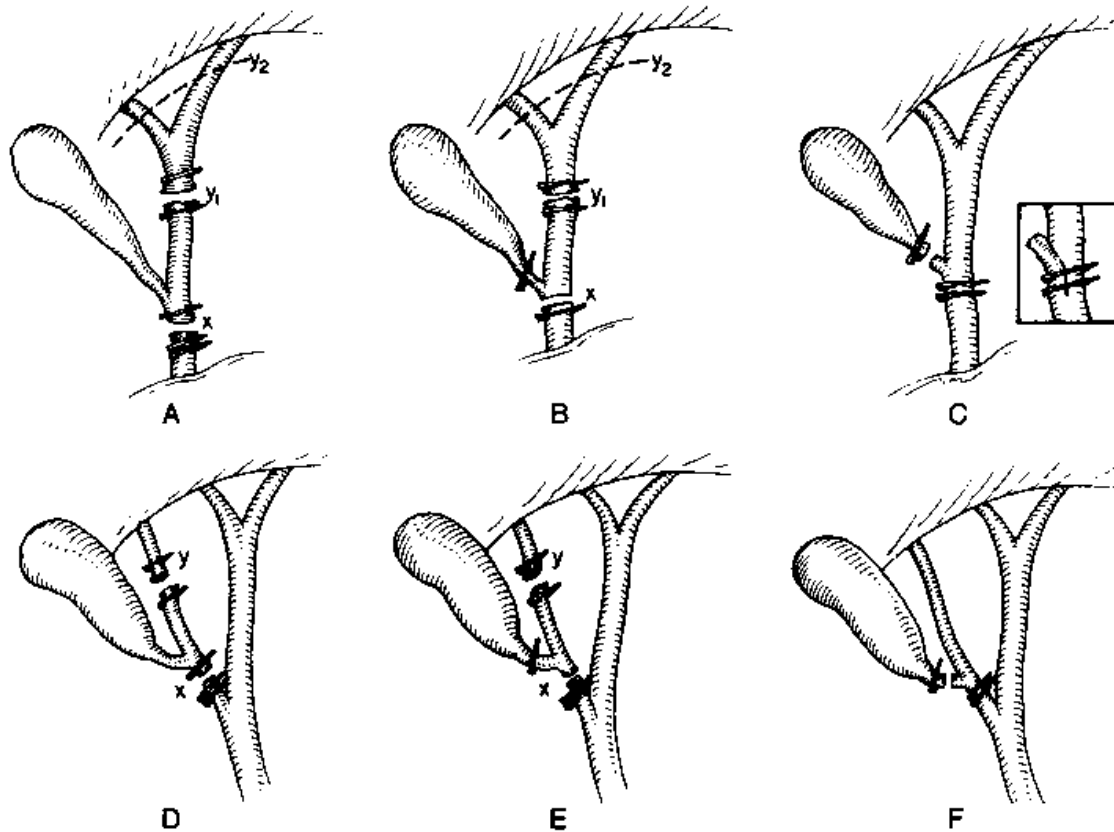
B) PATIENTS WITH DELAYED PRESENTATIONS (>24hrs after surgery):

In early post operative phase the symptoms are non-specific including malaise, nausea, vomiting, anorexia, abdominal pain, and low grade fever. It is this non-specificity of symptoms that probably delays the diagnosis. These patients may be further grouped into two categories

1) Patients with biliary leakage immediately or a few days after initial surgical procedure resulting in a biloma, biliary fistula, biliary peritonitis.

2) patients with total occlusion of the CBD leading early obstructive jaundice frequently followed by biliary leakage and peritonitis due to increasing intraductal pressure and subsequent leakage from the site of the injury.

VARIOUS PATTERNS OF BILIARY TRACT INJURY



- A** : Classic injury.
B and C : Variants of the classic injury.
D–F : Different injuries resulting from the cystic duct originating from an aberrant right hepatic duct.

C) PATIENT WITH A RELATIVELY LONG SYMPTOM FREE INTERVAL(> 1 year)

These patients present with obstructive jaundice due to stricture with or without cholangitis. If not presenting early some of these patients may end up with secondary biliary cirrhosis and portal hypertension. Which markedly increase the morbidity and mortality.

POST CHOLECYSTECTOMY SYNDROMES

Postcholecystectomy syndrome (PCS) describes the presence of symptoms after cholecystectomy. These symptoms can represent either the continuation of symptoms thought to be caused by the gallbladder or the development of new symptoms normally attributed to the gallbladder. PCS also includes the development of symptoms caused by removal of the gallbladder.

In general, PCS is a preliminary diagnosis and should be renamed relevant to the disease identified by an adequate workup. PCS is caused by alterations in bile flow due to the loss of the reservoir function of the gallbladder. Two types of problems may arise. The first problem is continuously increased bile flow into the upper GI tract, which may contribute to esophagitis and gastritis. The second consequence is related to the lower GI tract, where diarrhea and colicky lower abdominal pain may result.

The common causes include retained or recurrent calculi, gallbladder or cystic duct remnants, bileduct stricture and injuries, papillary stenosis and dyskinesia

An extensive study of the patient should be performed in an attempt to identify a specific cause for the symptoms and to exclude serious postcholecystectomy complications.

Ultrasonography is currently the most accessible and cost-effective approach in most institutions. Other noninvasive techniques include hepatobiliary scintigraphy with technetium Tc 99m-labeled iminodiacetic acid, otherwise known as a hepatoiminodiacetic acid (HIDA) scan with and without calculation of cholecystokinin (CCK)-stimulated ejection fraction (EF). Computed tomography (CT) scanning, helical or spiral CT scanning, and, most recently, magnetic resonance cholangiopancreatography (MRCP) may be useful.

More invasive procedures that may prove valuable in defining the biliary anatomy include percutaneous transhepatic cholangiography (PTC) and endoscopic retrograde cholangiopancreatography (ERCP), with and without biliary and ampullary manometry and sphincterotomy.

The intraoperative cholangiogram (IOC), along with a variety of different instrumentation methods, has been in use in the evaluation of the bile ducts at the time of surgery. These procedures have helped reduce the incidence of PCS because of better preoperative evaluation and diagnosis, especially in patients without stones.

Once a diagnosis has been established, treatment should proceed as indicated for that diagnosis. As with medical therapy, surgical therapy should be directed at the specific diagnosis.

EXTERNAL BILIARY FISTULA

The vast majority of external biliary fistulas occur in the post operative period and mostly results from

- Leakage of bile from a slipped cystic duct ligature and transected accessory bile ducts.
- Trauma to the extrahepatic biliary tree during cholecystectomy, gastric and pancreatic surgery
- Dislodged T-tube after CBD exploration.
- Leakage from bilio-enteric anastomosis. and Hepatic resection.

BILOMA;

Bilomas are often seen following biliary surgery although they can also occur after trauma or erosion into the biliary tree from a malignant or inflammatory process. USG or biliary scintigraphy can be used to diagnose, to follow the quantity of biliary leakage and the size of the biloma.

Cholescintigraphy using Tc-99m-IDA is a very sensitive method for detecting and monitoring bile leaks.

BILIARY PERITONITIS;

Collection of bile either localized in gallbladder fossa or generalized in the peritoneal cavity produces biliary peritonitis. Usually presented with fever, chills,

abdominal pain, vomiting. This needs early intervention to diagnose and treat the cause.

INVESTIGATION

An extensive study of the patient should be performed in an attempt to identify a specific cause for the symptoms and to exclude serious postoperative complications.

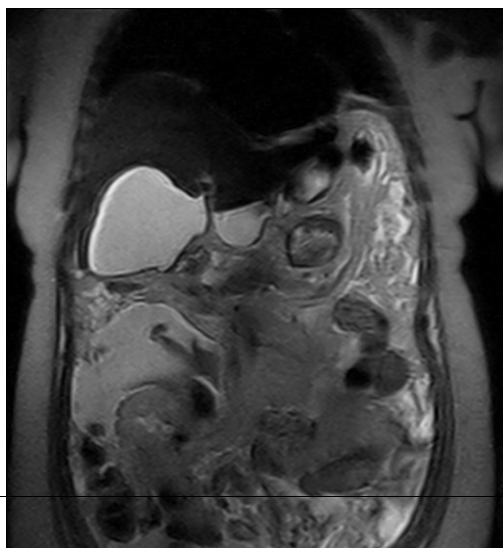
- Patient examination starts with a thorough history and physical (H&P) examination, with close scrutiny of the old record.
 - Particular attention should be paid to the preoperative workup and diagnosis, the surgical findings and pathologic examination, and any postoperative problems.
 - Discrepancies may lead to the diagnosis.
- Initial laboratory studies in the workup usually include a CBC count to screen for infectious etiologies, a hepatic function panel (HFP) and prothrombin time (PT) to screen for possible liver or biliary tract diseases, and, if the patient is acutely ill, a blood gas analysis. If laboratory findings are within reference ranges, consider repeating these studies when symptoms are present.

Imaging Studies

- A chest radiograph helps us to assess the chest status.
- Abdominal X-Ray are mandatory to exclude coexisting pathologies.

- An ultrasound study is almost always performed because it is a quick, noninvasive, and relatively inexpensive way to evaluate the liver, biliary tract, pancreas, and surrounding areas.
 - A 10- to 12-mm dilation of the common bile duct (CBD) is commonly observed.
 - Dilation of more than 12 mm is often diagnostic of distal obstruction such as a retained stone, CBD stricture, or ampullary stenosis.
- A CT scan can be helpful in identifying intrahepatic biliary dilatation, bile collection.(Biloma), retained stones.
- In patients who are not candidates for Oesophago gastro duodenoscopy and ERCP, a helical CT scan or MRCP may reveal the cause of post operative symptoms.

MRCP (BILOMA)



Nuclear imaging may demonstrate a postoperative bile leak. Occasionally, a HIDA scan or similar scintigraphic study may show delayed emptying or prolonged half-time, but these studies do not have the resolution to identify dilation, stricture, and so on. Emptying delayed by more than 2 hours or prolonged half-time can help identify the sphincter of Oddi as a potential cause but cannot differentiate between stenosis and dyskinesia..

DIAGNOSTIC PROCEDURES

- An EGD procedure can be very helpful in the workup of PCS.
 - EGD also allows direct visualization of the ampulla of Vater.
- The most useful test in the diagnosis is ERCP.
 - ERCP is unsurpassed in visualization of the ampulla, biliary, and pancreatic ducts.
 - An experienced endoscopist can confirm this diagnosis in most of these patients and can also provide additional diagnostic studies such as biliary and ampullary manometry.
 - Delayed emptying can be observed during ERCP as well as with HIDA scan.
 - The CBD should clear of contrast within 45 minutes. Biliary manometry is performed in patients sedated without narcotics with a perfusion catheter; a pull-through technique is used for sphincter manometry.

As technology improves, it will be easier to detect retrograde contractions or increased frequency of contractions (also called tachyoddia).

A percutaneous transhepatic cholangiogram (PTC) or MRCP may be of use in patients who are not candidates for or who fail in ERCP attempts.

BILIARY INTERVENTION:

Once a diagnosis has been established, treatment should proceed as indicated for the diagnosis. Surgical therapy should be directed at the specific diagnosis.

NONOPERATIVE

PERCUTANEOUS INTERVENTION:

Percutaneous biliary drainage

Percutaneous biliary stenting

Percutaneous cholecystostomy

ENDOSCOPIC INTERVENTION

At the time of ERCP, therapeutic maneuvers can be performed

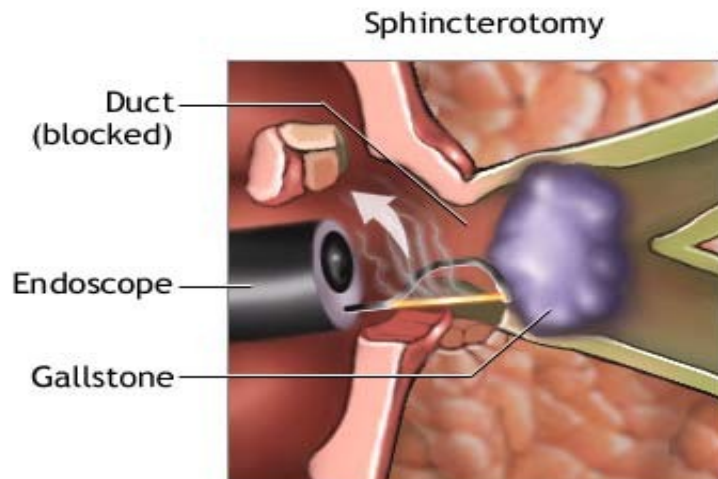
Endoscopic naso-biliary drainage

Endoscopic sphincterotomy

Endoscopic stent placement

Endoscopic sphincterotomy and stone removal

Endoscopic sphincterotomy and stenting

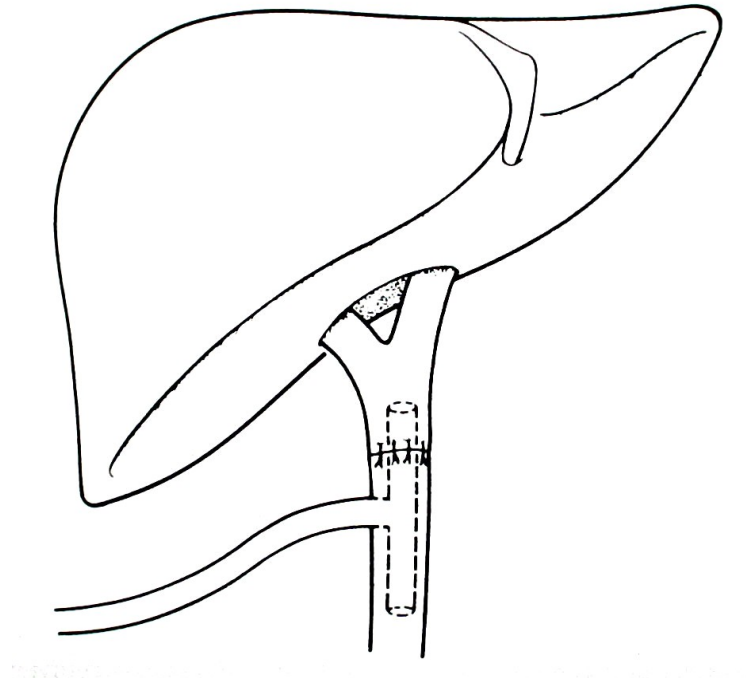


OPERATIVE INTERVENTION:

CBD EXPLORATION WITH

- A) STONE RETREIVAL
- B) T-TUBE DRAINAGE
- C) T-TUBE REPAIR
- D) END TO END ANASTOMOSIS
- E) STRICTUROPLASTY

END-TO-END ANASTOMOSIS OVER A T- TUBE

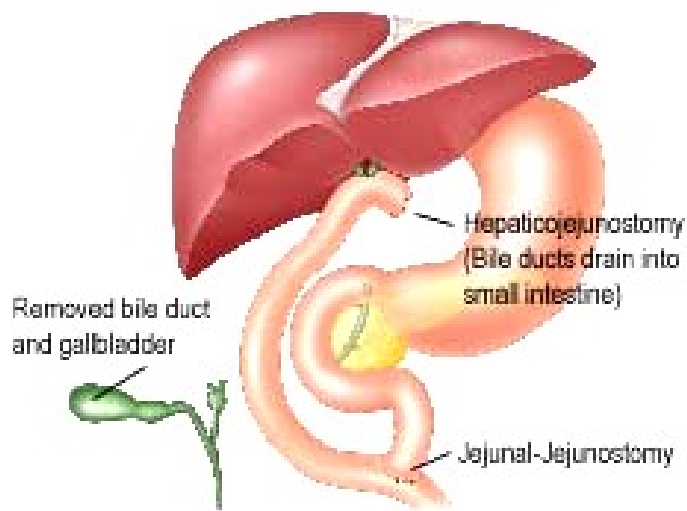


BILIARY DRINAGE

- A) EXTRA HEPATIC BILIO-ENTERIC .
- B) INTRA HEPATIC BILIO-ENTERIC
- C) PORTO- ENTERIC

EXTRAHEPATIC BILIARY DRAINAGE

- A) Choledocho- duodenostomy
- B) Choledocho jejunostomy
- C) Cholecysto jejunostomy
- D) Cholecysto gastrostomy
- E) Cholecysto duodenostomy
- F) Hepatico jejunostomy



Roux-en-Y Hepaticojejunostomy Procedure performed for injuries and cancer of the bile duct.

INTRAHEPATIC BILIARY DRAINAGE

- A) SEGMENT III HEPATICO JEJUNOSTOMY
- B) RIGHT SIDED INTRA HEPATICO JEJUNOSTOMY

PORTO ENTERIC

KASAI OPERATION AND IT'S MODIFICATION.

AIM OF THE STUDY

- To analyse the presenting features in patients who has had earlier biliary surgery.
- Time interval of the earlier procedure and complication was evaluated.
- We looked in to the factors which required readmission, re-evaluation and need for repeat intervention.
- The morbidity and mortality duo to re intervention.

PATIENTS AND METHODS

This is a study of 25 cases of repeat biliary intervention done in our Department of General Surgery and Department of Surgical Gastroenterology Govt Royapettah Hospital and Kilpauk Medical College during the period from March 2004 to August 2007

INCLUSION CRITERIA

All the patients who had repeat biliary intervention were included regardless of gender, age.

EXCLUSION CRITERIA

The patient who had hepato biliary malignancies were excluded from the study.

STUDY DETAILS

Data regarding the number of cases, gender, age and the type of surgical intervention was collected on printed Performa as a prospective basis.

The details of investigation, location of pathology, management strategies and difficulties faced were evaluated.

RESULTS OF STUDY

A total of twenty five cases were identified during the three years period from March 2005 to October 2007. Eight cases had primary surgery in our hospital and seventeen had primary surgery elsewhere. Of the twenty five cases six was done as an emergency basis. Fifteen were female, age ranging from 26 – 62 years while ten male age between 25- 56 years.

They had different symptoms at presentation. Time between the first operation and presentation with symptoms ranged from immediately after the first surgery to three months of interval. Most of the stricture identified 3-6 months later, retained stones 2-6month after the initial surgery. Biliary leak and biloma presented in the early post operative period in 2 -6 weeks interval.

TIME OF PRESENTATION

| TYPE OF LESION | TIME INTERVAL |
|-----------------------|----------------------|
| Strictures | 3-6 months |
| Retained stones | 2-6 months |
| Bile leak and Biloma | 2-6 weeks |

In the studied group of twenty five patients, twelve of them had laparoscopic cholecystectomy, nine had open cholecystectomy and four had open CBD exploration for ductal stone.

| <i>PRIMARYSURGERY</i> | NO |
|------------------------------|-----------|
| Lap.cholecystectomy | 12 |
| Open cholecystectomy | 9 |
| Open CBD exploration | 4 |

COMMON SYMPTOMS AND SIGNS

- fever with rigor
- pain epigastric and right hypochondriac region
- jaundice
- pruritis
- vomiting
- abdominal distension
- tenderness and guarding right hypochondrium

WORK UP

Initial laboratory studies in the workup usually include a CBC count to screen for infectious etiologies, a hepatic function panel (HFP) and prothrombin time (PT) to screen for possible liver or biliary tract diseases, and, if the patient is acutely ill, a blood gas analysis.

Ultrasonogram was done invariably for all the patients. It revealed biloma in one patient, proximal CBD dilatation in eight patients and retained CBD stone in eight patients

ERCP was done in sixteen patients and showed stricture at various level in seven patients and bile leak in four patients.

Computed tomography scan was done in fourteen patients showed biloma in one patient and dilatation of extra/ intra hepatic biliary tracts in eight patients.

MRCP revealed high biliary stricture in one patient, stricture in CHD and CBD various level in 9 patients.

T-tube cholangiogram for 7 patients was done after ten days of surgery and no leak was found. In these cases following tubogram T-tube was removed after seven days.

DIAGNOSTIC MODALITIES

| INVESTIGATION | NO OF CASES |
|------------------------|-------------|
| Ultrasonogram | 25 |
| Computer tomography | 14 |
| ERCP | 16 |
| MRCP | 10 |
| T-tube cholangiography | 7 |

The causes for reoperation included bile duct stricture in 11 patients (44%), retained bile duct stones in 8 patients(32%) ,biliary leak in 5 patients (20%) and biloma in 1 patient (4%).

TYPES OF LESION

| SITE/TYPE OF LESION | NO | PERCENT |
|---------------------|----|---------|
| BILIARY STRICTURE | 11 | 44% |
| RETAINED STONE | 8 | 32% |
| BILIARY LEAK | 5 | 20% |
| BILOMA | 1 | 4% |

The most common problem encountered was bile duct stricture. They were managed with Roux-en-Y hepaticojejunostomy in eight patients, choledochoduodenostomy in one patient and one patient who had high stricture was managed with segment III bypass. One of them underwent ERCP guided stenting.

The next common type of lesion for which re-intervention done was retained stones in eight patients. Four of them had ERCP, sphincterotomy and stone removal. Four of them had open CBD exploration and T-tube repair.

Five patients had biliary leak following earlier procedure. Three of them were managed with open CBD exploration with T-tube drainage. Two of them had ERCP guided stenting.

One patient who presented with biloma was managed with Ultrasound guided drainage. The Patient recovered well and is symptoms free at one year follow up.

PROCEDURE EMPLOYED FOR MANAGEMENT

| <i>PROCEDURE</i> | NO | PERCENT |
|---------------------------------------|-----------|----------------|
| Roux-en-Y Hepatico jejunostomy | 11 | 32% |
| Choledochoduodenostomy | 1 | 4% |
| High segment III bypass | 1 | 4% |
| USG guided drainage | 1 | 4% |
| T-tube repair | 7 | 28% |
| ERCP sphincterotomy and stone removal | 4 | 16% |
| ERCP- stenting | 3 | 12% |

FOLLOW UP

Follow up is essential in all patients who undergo repeat biliary intervention. The patient and their family members are adequately educated about the possible symptoms. They are instructed to report to the hospital for follow-up at twice monthly intervals.

DISCUSSION

Lapse in the pre op evaluation of bile duct pathologies leads to serious complication. The appropriate B- mode ultrasound, CECT, ERCP and MRCP helps are to make.

The incidence of bile duct injuries is difficult to quantify but commonly accepted to be 0.1%-0.2% of all open cholecystectomy and 0.5% -0.8% of all cases of laparoscopic cholecystectomy. Nevertheless, laparoscopic cholecystectomy is now the gold standard for uncomplicated gallstones.

In laparoscopic cholecystectomy, bile duct injuries are more likely to occur when the procedure is difficult because of bleeding, acute inflammation or dense chronic inflammation. Inexperience on the part of the operator is also a risk factor.

This study has been shown to be CBD injuries most commonly near the vicinity of the cystic duct continues to be the major problem and most of these injuries are due a misinterpretation of the anatomy in and around Calot's triangle.

PREVENTION

A thorough knowledge of the anatomy of the region including the possible anomalies is important in preventing iatrogenic bile duct injuries. Both open and LC are based on similar operative principals.

Proper exposure and visualization, careful dissection, adequate hemostasis, careful placement of ligatures and clips and division of structures after proper identification are the essence of safe cholecystectomy.

LAPAROSCOPIC CHOLECYSTECTOMY

The early prediction that the rate of bile duct injury during LC would decline substantially with increased experience has not been fulfilled. Since the injuries occurring at LC are frequently more severe and extend to a higher level than in open cholecystectomy (Strasberg E3 to E5 injuries occur in 31% of LC against 12% of open cholecystectomy) prevention should always be the aim.

- Maximum cephalic fundal traction for better visualization of the Calot's triangle.
- Lateral and inferior traction on the Hartman's pouch opens up the angle between the CD and the CHD and avoids their alignment.
- Calot's triangle must be freed of fatty and areolar tissue.
- Dissection to be started near the neck of the gall bladder (cystic lymph node is an important land mark) and then proceed from the lateral to the medial direction, keeping close to the gall bladder.
- Freeing the posterolateral attachments of the gall bladder to the liver creates a good window and the junction of the neck of the gall bladder and the CD is defined all round. Visual identification of the CBD is not essential or recommended.
- A 30° telescope is preferable as it can be turned to achieve an en face view of the Calot's triangle. Withdrawing the telescope intermittently gives the surgeon an overall perspective and spatial orientation.
- Clips are to be placed close to the gall bladder after proper visualization of both their limbs. A short or wide CD should preferably be tied.

- Excessive and unnecessary dissection or use of electrocautery near the CBD to be avoided. Cautery to be used at very low power setting in Calot's triangle.
- Electrocautery on tissues close to metal clips concentrates thermal energy and desiccates the tissue making the clips less secure predisposing to bleeding and biliary fistula and hence should always be avoided.
- Any bleeding should be controlled only after accurate identification of its source and the neighboring structures.
- Dissection should be close to the gall bladder while it is separated from the liver bed.
- Always better to seek the opinion of senior colleagues of the same institution if one feels "lost"; if doubt persists convert to open cholecystectomy-it only shows good judgment.

OPEN CHOLECYSTECTOMY

- Adequate incision, good retraction and able assistance help in proper exposure and visualization and are prerequisites for safe cholecystectomy.
- Proper identification of the structures of the Calot's triangle before any structure is ligated or divided. It is important to remain close to the gall bladder during dissection to avoid injury to the RHD or one of its anomalies.
- If the anatomy is not clear a cholecystostomy or partial cholecystectomy is preferable.

- In cirrhosis, excessive bleeding during separation of the gall bladder may be reduced by leaving the posterior wall of the gall bladder denuded of its mucosa, attached to the liver bed.
- When haemorrhage obscures the anatomy one should refrain from using clamps blindly. Instead, Pringle manoeuvre helps in better visualization and accurate placement of clips and clamps.
- Both antegrade and retrograde cholecystectomy may be associated with CBD injury and thus neither should give a false sense of security to the operating surgeon.

MEASURES FOR PREVENTION OF RECURRENCE STONES

It is essential, to reduce incidence of residual stones by proper pre operative investigation and ascertain the number, location, size of stones and whether stenosis or dilatation of the bile duct co-exist. Using intraoperative B-mode USG, choledochoscope, can reduce the residual stones to the extreme.

CONCLUSION

This study highlights the important issues as the occurrences and need for repeat biliary intervention following benign biliary disease.

One could identify that inadequate preoperative evaluation, intra operative problems like difficult anatomy, uncontrollable bleeding and inadequate mobilisation of structures are the important issues leading to repeat biliary intervention.

While on operation the problem like difficult anatomy, uncontrolled bleeding and inadequate mobilization of structure are the important issues leads to re peat biliary intervention.

Timing, planning re –evaluation and proper selection of appropriate management strategies are important in restoring the biliary anatomy in these patient.

Repeat intervention is ideally performed at a tertiary care center where the entire specialty of investigation, skilled personals, interventional radiologist, gastroenterologist and surgeon with biliary skills are available.

The deligence and caution is essential in biliary surgeries to avoid complication which leads on to immense economical loss to the patient and family. Extra care during the primary procedure will avoid time consuming followup and reinterventions.

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STUDY FORMAT

Name :

Age :

Sex : a) Male b) Female

In Patient no :

Date of admission :

Date of discharge :

HISTORY

A) Nature /Cause of Primary biliary surgery

B) Time of patient presentation

C) Nature of presenting complication

- Retained stones / reformed stones
- Bile duct injuries
- Bile leak
- Biloma

CLINICAL FEATURE

EVALUATION OF PATIENT

Routine basic hematological investigation

Liver functions test

Imaging modality

X-RAY CHEST / ABDOMAN

USG

CECT

MRCP

INVASIVE / IMAGING MODALITY

ERCP

DIAGNOSIS OF POST SURGICAL COMPLICATION

EVALUATION OF PATIENT COMORBID CONDITION

MANAGEMENT STRATEGY

FOLLOW UP